

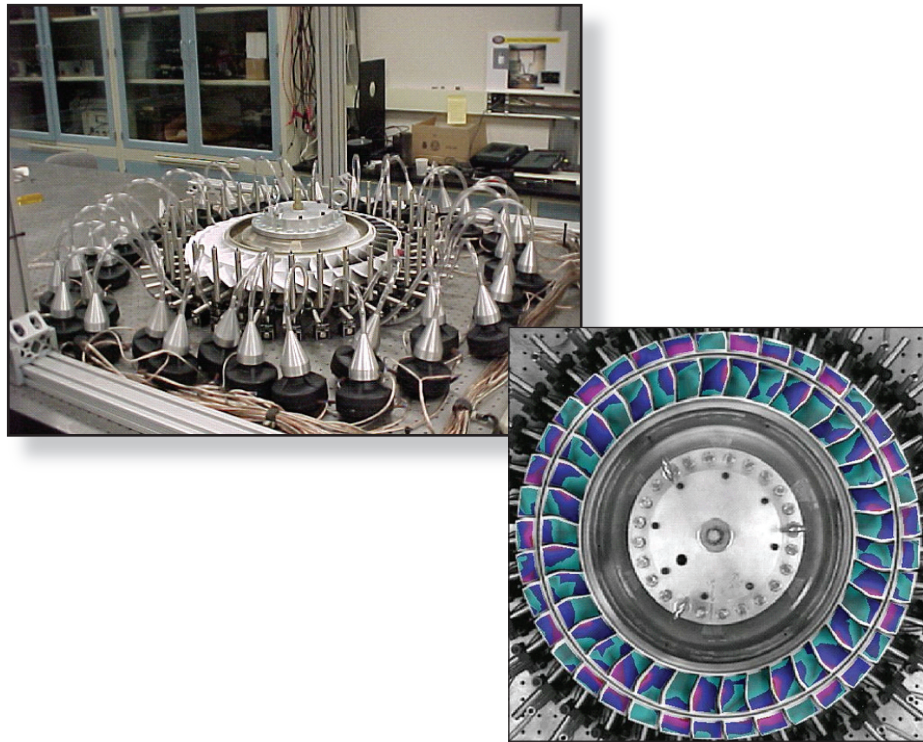


Air Force Research Laboratory|AFRL

Science and Technology for Tomorrow's Air and Space Force

Success Story

AFRL SCIENTISTS USE INNOVATION TO ACHIEVE RESULTS



AFRL Propulsion Directorate scientists developed the Traveling Wave Excitation (TWE) system to simulate turbine engine rotor operational environments without the use of expensive, time-consuming, high-risk rotating tests. The TWE system successfully highlighted the dynamic behavior leading to high vibrations in the core-driven fan stage (CDFS) and provided experimental results that guided modifications of the rotor blades. Subsequent testing of the CDFS showed a significant reduction in stresses. The availability of AFRL's TWE technology provides an important experimental capability that will contribute significantly to the reliability and safety of future military turbine engines.



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Accomplishment

The CDFS is a key feature in the General Electric/Allison Advanced Development Company team's variable-cycle architecture for the XTC76/3 engine, part of the Integrated High-Performance Turbine Engine Technology (IHPTET) program. The CDFS consists of rows of inner and outer airfoils separated by a solid shroud to split core and bypass flow in a single rotating stage. During initial testing of the XTC76/3 engine, large vibrations and high stresses were observed in the CDFS, requiring further investigation to mitigate risk for high-cycle fatigue, which could result in blade failures.

However, standard structural analysis techniques were not effective for understanding the behavior of the CDFS due to its unique geometry. The CDFS was tested in AFRL's Turbine Engine Fatigue facility using an innovative TWE system. Scientists developed this system in-house to eliminate the need for costly and high-risk rotating tests. It simulates engine vibratory conditions in a well-controlled laboratory environment.

Background

AFRL developed the TWE system in its Turbine Engine Division's High-Impact Technologies in-house program. It is an important tool for in-house research efforts, as well as an ideal experimental test bed for transitioning scientific results to applied technology and development programs such as the IHPTET program. IHPTET is an aggressive technology development plan to surpass technology barriers and deliver twice the propulsion capability of today's turbine engine systems by 2005.

Additional Information

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTC, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (04-PR-27)

Propulsion
Emerging Technologies